



Fusion[™]

DEVELOPER SUMMIT





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***ADVANCED RENDERING EFFECTS
USING OPENCL™ AND APU***
Session 2117

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CONTENTS

- Rendering Effects
- Before Fusion: single discrete GPU case
- Before Fusion: multiple discrete GPU case
- With Fusion: APU + discrete GPU
- User Interface case
- Scene and Environment case

RENDERING EFFECTS



GRAPHIC ENGINE FREQUENT CASE

- Distinct rendering tasks that:
 - Do not share resources (texture/geometry)
 - Have different update frequency / refresh rate
 - Have different priorities (when it is ok to skip a few frames for the benefit of the other task)
- Typical example is User Interface on top of a content creation package, or animated environment scene (clouds, water, trees,...)

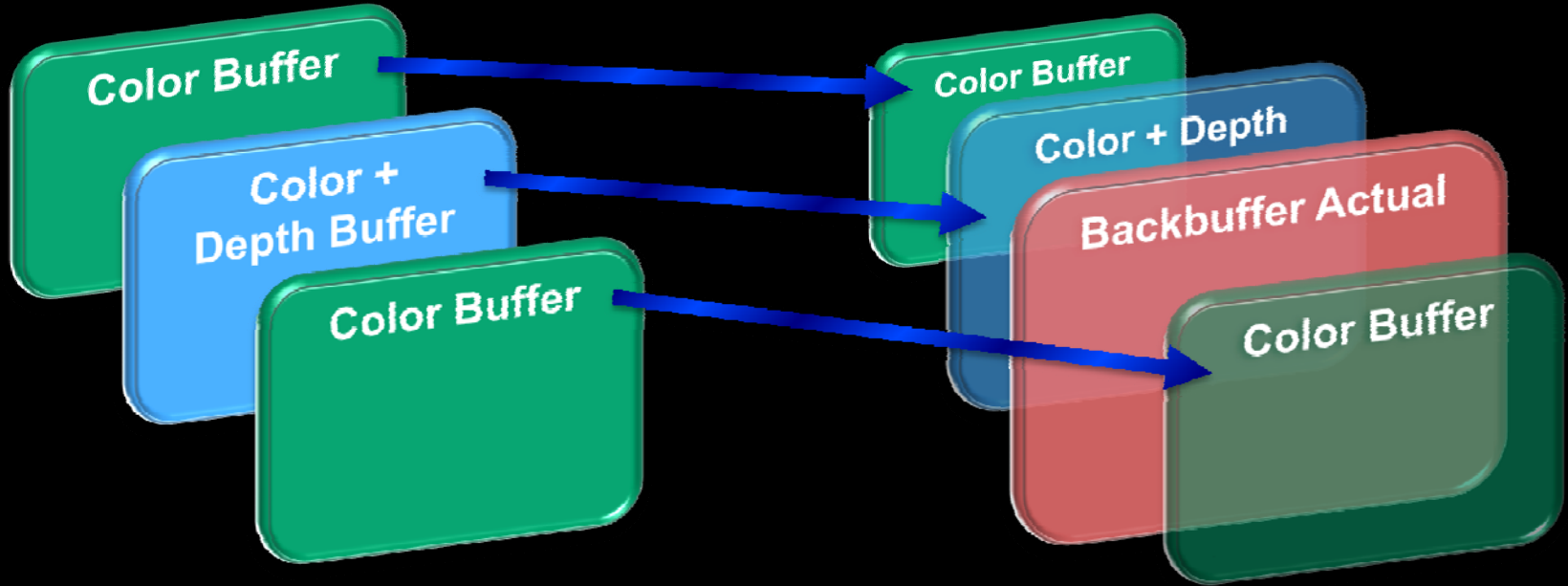
OFF-SCREEN RENDERING AND COMPOSITION

- Render targets are your best friend
 - Framebuffer Object (FBO) / RenderTargets
 - Specific size/format according to need

- Open the door to many special effects
 - Shadow (map, SSAO,...)
 - Animated/distorted reflection (water/glass)
 - Overlay/Background
 - PostProcess (blurring, grayscale)

- Allow optimization in the engine
 - Layer cache

RENDER TARGETS AND COMPOSITION



SINGLE GPU BEFORE FUSION



SINGLE GPU CASE

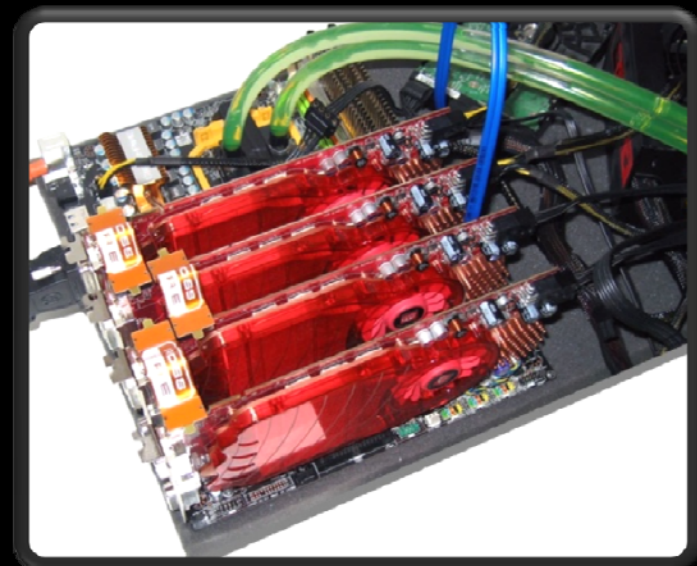
- Single thread:
 - Time slice only works if workload is predictable (UI is not)
 - One rendering task will stall the other
- Multithreading:
 - Create 2 threads with their own OpenGL contexts : bad performance if shared
 - Only 1 thread owns OpenGL means only data, no rendering in other thread : hard to sync
 - 2 threads with only 1 OpenGL context and switch current : not ideal
- Bottom line: a single GPU doesn't like to be shared!

MULTI GPU BEFORE FUSION



MULTI – DISCRETE GPU

- AMD CrossFire™ / SLI
- Deployment
 - Power
 - Heat
 - Space
 - Cost
 - Better with identical cards



MULTI – DISCRETE GPU

- Workload Balancing
 - No fine control
 - GPU Affinity (`WGL_AMD_gpu_association`)
 - Brute force
 - Alternate Frame Rendering
 - Split Frame Rendering
 - Tiled Rendering

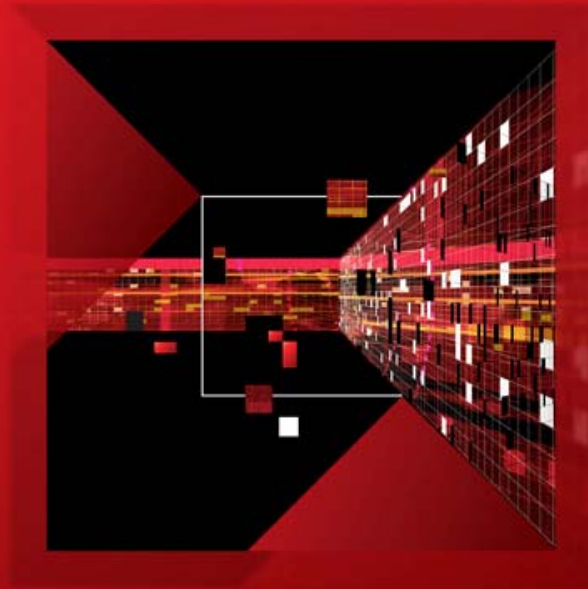


MULTI – DISCRETE GPU

- Resource Balancing
 - 2x, 3x or 4x 1GB cards, still only 1GB VRAM available
 - Textures
 - Geometry
 - Even with affinity: no sharing possible without slow copy



APU + DISCRETE GPU



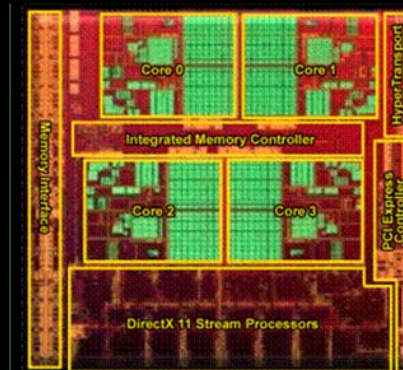
APU + DISCRETE GPU

- Fusion advantage
- Deployment
 - Low Power
 - No Extra Heat
 - Space
 - Cost



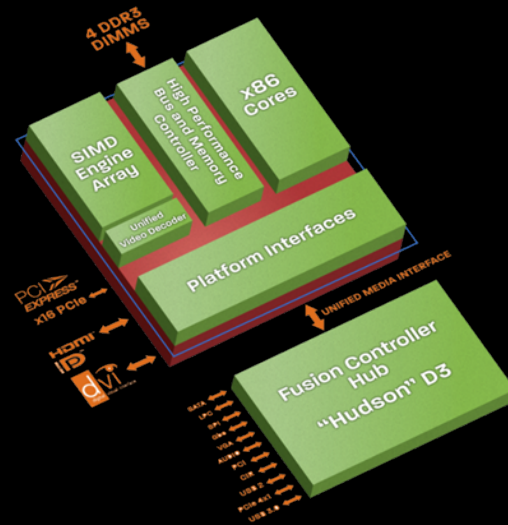
APU + DISCRETE GPU

- Workload Balancing
 - Fine control through OpenCL™
 - Delegate specific tasks to the APU
 - Background Layer
 - Overlay Layer
 - Color buffer
 - Color + Depth buffer
 - Composition on the discrete GPU
 - Blending
 - Depth testing

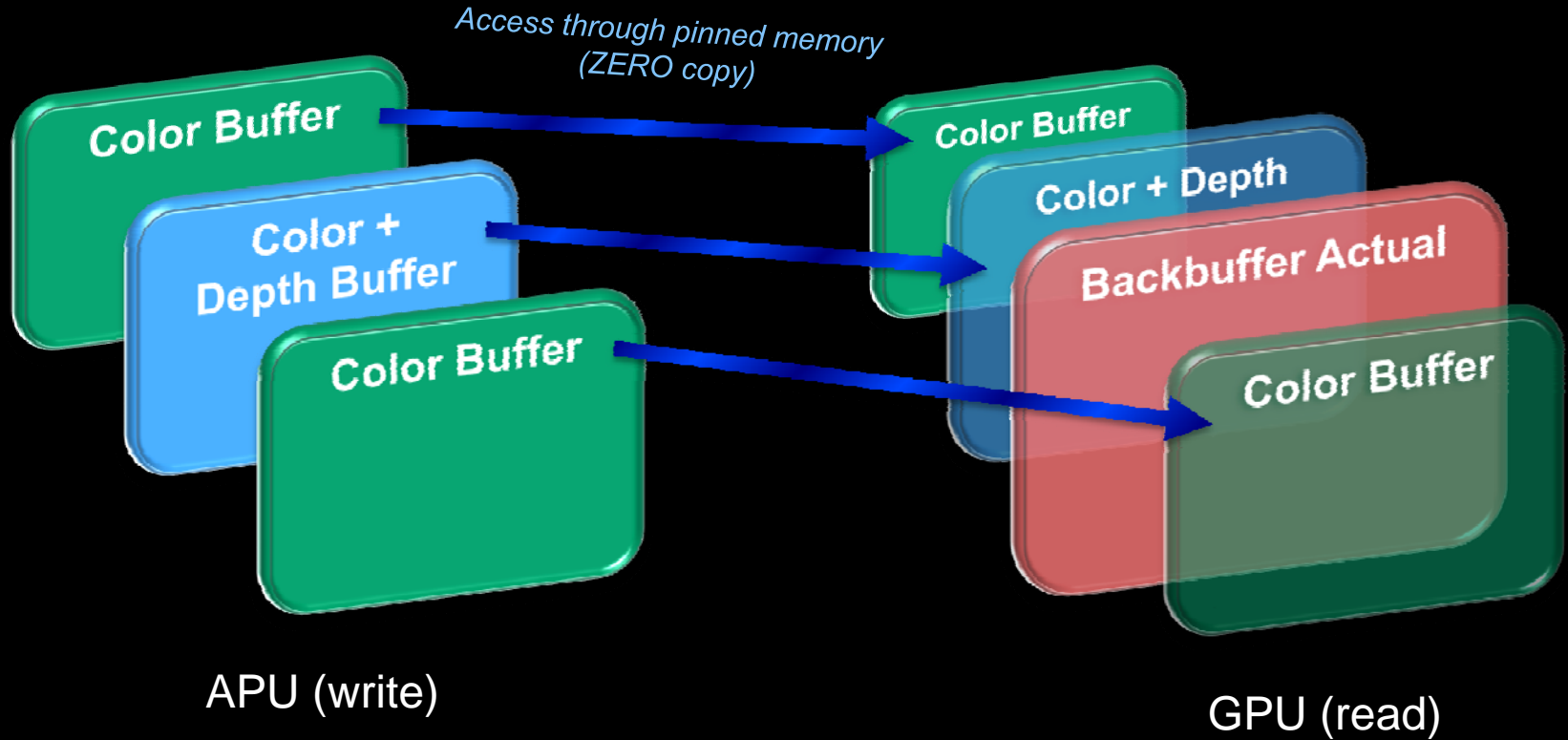


APU + DISCRETE GPU

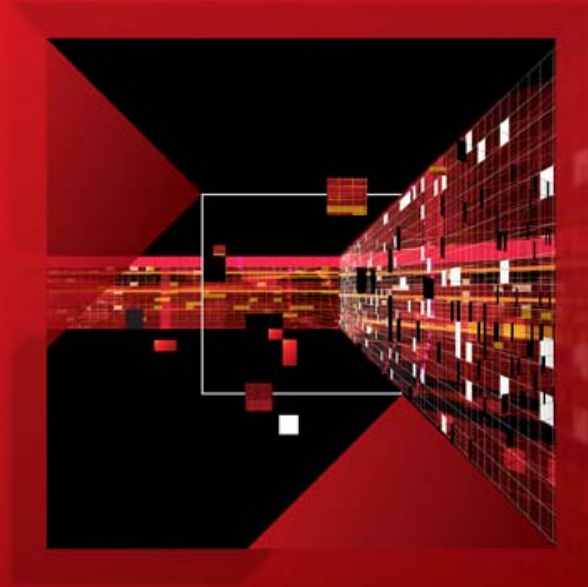
- Resource Balancing
 - Only load resources for the task at hand
 - Textures
 - Geometry (scene)
 - Fast sharing through Pinned memory



SHARING LAYERS THROUGH PINNED MEMORY

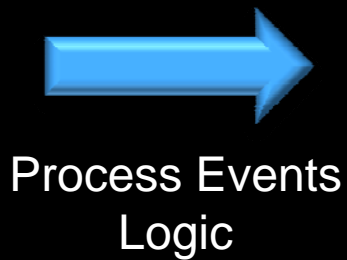
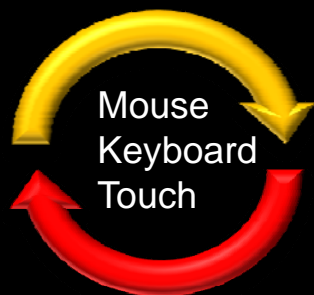


USER INTERFACE

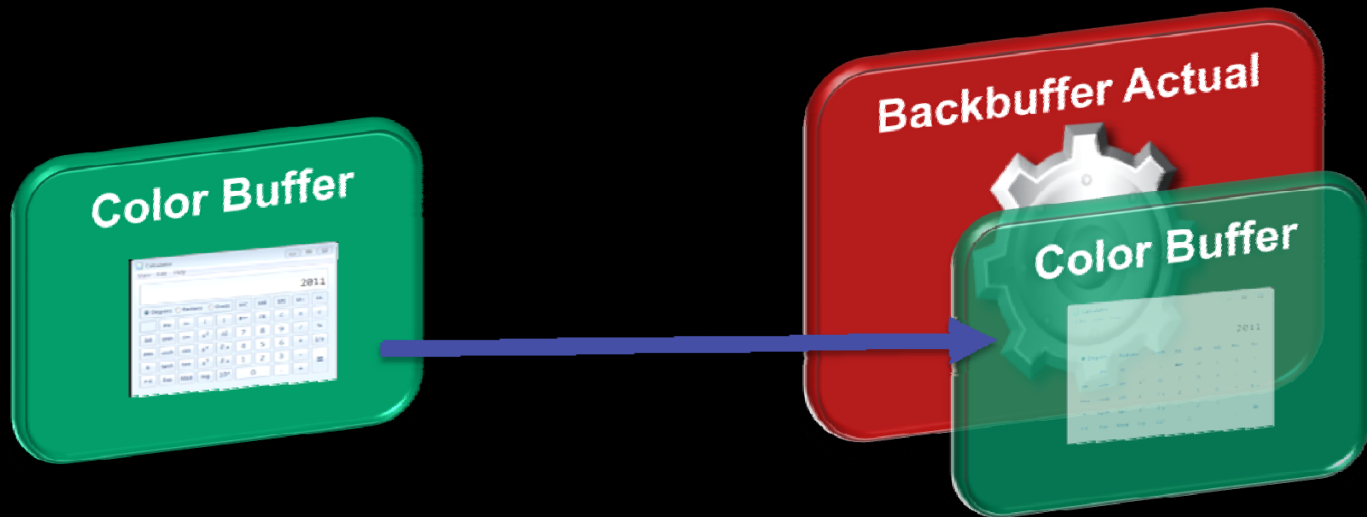


DEDICATED UI THREAD ON THE APU

User Events



CUSTOM USER INTERFACE



APU
Processing User Input logic
Rendering UI on layer
Can be Animated: free for actual

GPU
Rendering actual
Blending UI result

RENDERING UI INSIDE THE SCENE

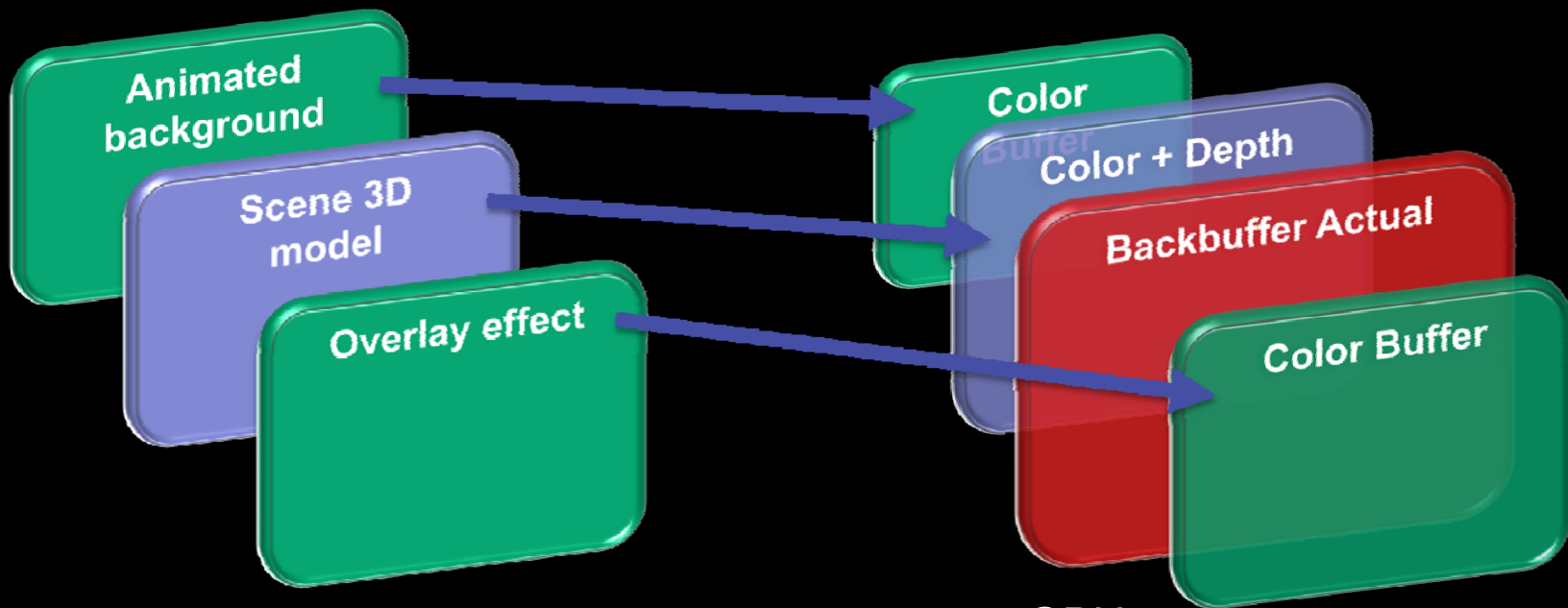
- Resulting texture interleaved
 - Immersive feeling
 - Cool user experience
 - Better relate to context



SCENE AND ENVIRONMENT



SCENE & ENVIRONMENT



APU

Rendering particles effect
Rendering 3D scene

GPU

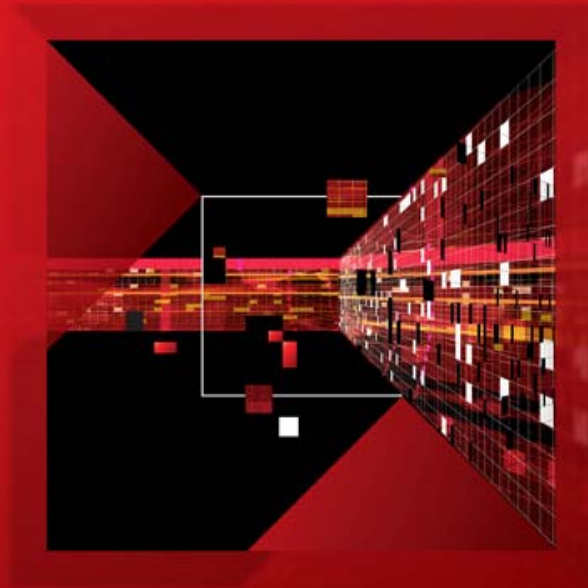
Rendering actual
Depth composition
Blending overlay

ANIMATED ENVIRONMENT

- Floor pad, surrounding



CONCLUSION



FINAL THOUGHTS

- These are not new techniques but...
 - Hard to budget with only one GPU
 - Priority to content / user experience

- APU opportunity:
 - Extra horsepower
 - Architecture allowing optimized resource access/zero copy

QUESTIONS



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